



CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT (CAASD)

NextGen Integration and Evaluation Capability Concept of Use [1]

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 - FAA for sponsoring this work
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Purpose and Scope of NIEC Concept of Use

- Describes how the NIEC can be used for developing, refining, and validating operational concepts for NextGen through the mid-term (2012-2018).
 - Detailed information on NIEC capabilities described elsewhere [2]
- Does not propose a role or niche for NIEC, validate that the uses identified are unique or better than other similar services available or provide detailed information on each of the capabilities in the NIEC.
- Intended audience includes FAA Program Managers, NIEC Management, and potential NIEC customers.



Doing Business with the NIEC

Organizations interested in working with the NIEC to research NextGen concepts should contact the NIEC Manager Hilda DiMeo (AJP-784), NextGen and Operation Planning Manager at Hilda.DiMeo@faa.gov or 609-485-6843 to begin initial discussions regarding project requirements.



CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT (CAASD)

Profile of the NIEC



General Information

- **NIEC Management**

- Resides with FAA WJHTC Lab Services organization, specifically NextGen and Operation Planning Manager, located at the William J. Hughes Technical Center

- **Vision**

- To provide a research and development platform to aid in the implementation of NextGen Operational Improvements and other aviation-related research. The NIEC will continue to evolve to accommodate the needs of NextGen research.

- **Mission**

- Foster the exploration, evaluation and integration of NextGen enabled components within a rapid prototyping environment for concept validation and maturation [3].

- **Partnerships**

- The NIEC has formal and informal partnerships with industry, academia, other government agencies, and other FAA organizations

FAA William J. Hughes Technical Center

NIEC Environment

- Predator-B Ground Station and Simulator
- ScanEagle Ground Station and Simulator
- RQ7B Shadow 200 Ground Station and Simulator
- GE Aviation Systems, Inc. 4DT FMS
- 35" Display for Briefings, etc.
- Data Collection Personal Computer
- CDTI
- Fast-time Modeling

- 2K Displays (R,D, Supervisory; En Route or Terminal)
- TFMS Display
- Observation Window
- SWIM ITWS

- Out the Window Display
- Tower Flight Data Manager
- DBRITE

- TFMS
- Clearance Delivery Pre-Departure
- Traffic Based Flow Management
- AOC
- Simulation Management and Control

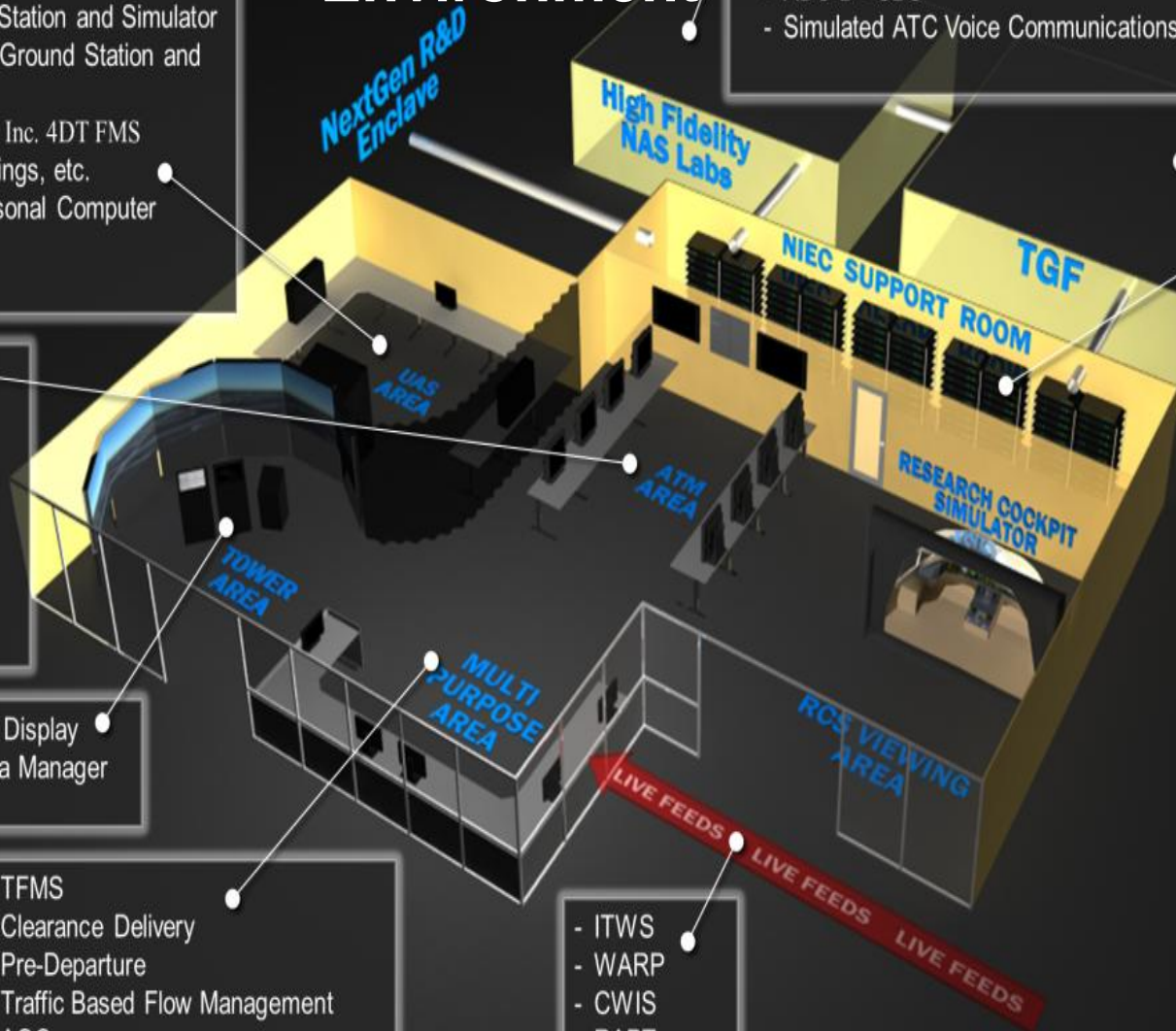
- ITWS
- WARP
- CWIS
- RAPT
- ADS-B Feed

- ERAM
- STARS
- CARTS
- Data Communications
- TPC - Mini TPC, TFM Test Tool
- Weather
- ADS-B - SBS
- Simulated ATC Voice Communications

- Simulation Pilot Workstations
- DESIREE
- Simulated and Live Radar Data
- Target Generation Engine
- ADS-B, TIS-B, FIS-B Service Simulator

- CAPABILITIES**
- JEDI (URET)
 - TBFM
 - HADDS
 - ERAM Evaluation System (EES)
 - WARP
 - TGF
 - Emulated En Route, Terminal and Tower (DESIREE)
 - Emulated CDTI, ASD-X, DBRITE, TODDS and DSR
 - Infrastructure (Data Recording, Scenario Development)
 - ATM Voice Communications

- DATA**
- NAS Adaptation Data
 - ERAM Adaptation
 - STARS Maps
 - Flight data
 - Weather Data
 - Restricted Access Data





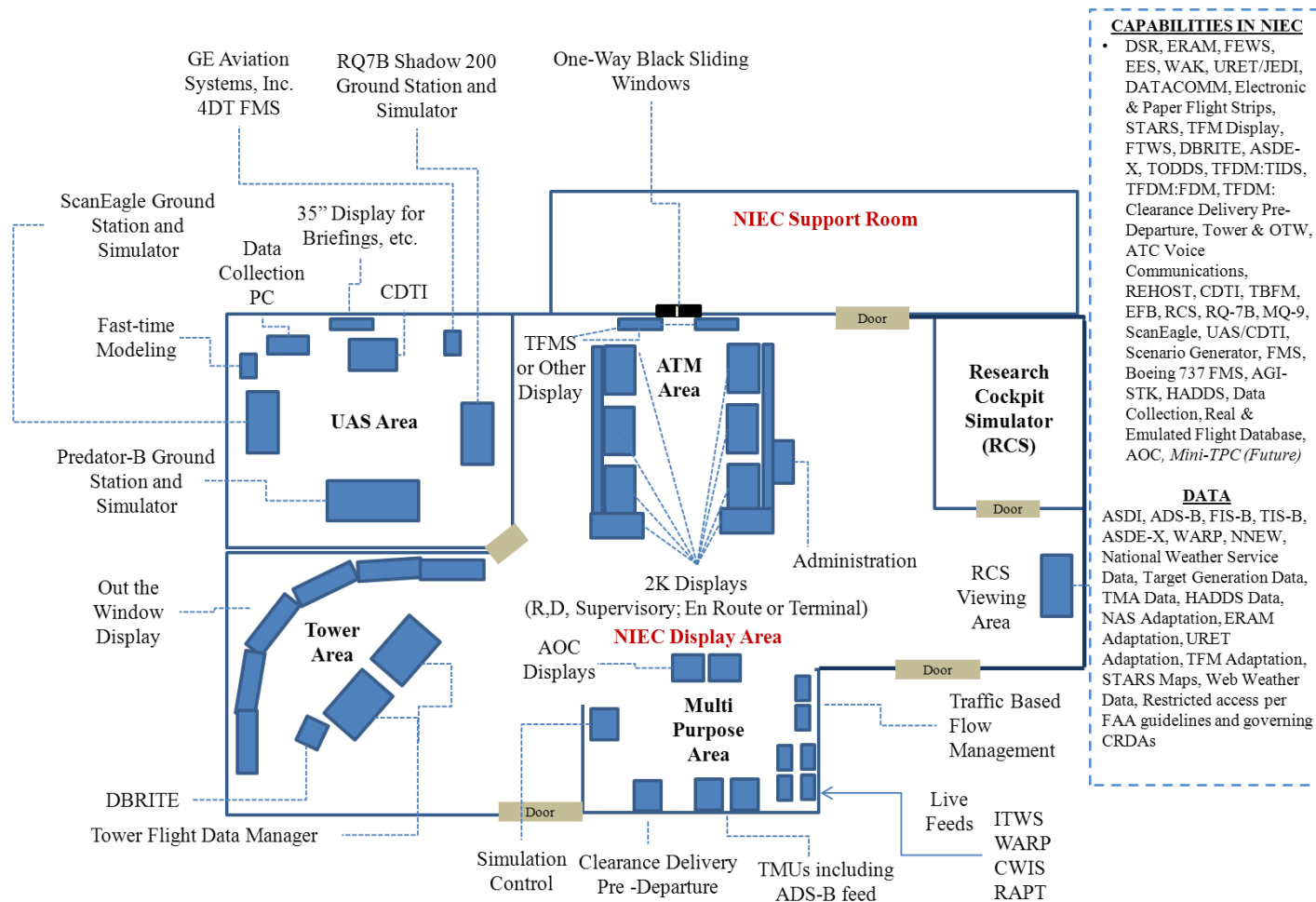
Features of the NIEC

- Simulations of NAS systems
- Representation of NAS domains in one lab
- Integration across NAS domains
- Support for multiple configurations
- Extensive interfacing with other capabilities
- Inclusion and integration of future capabilities
- Conformance to ATM system interfaces
- Inclusion and integration of UAS in the NAS environment
- Ingestion of real adaptation and other NAS data
- Recording and playback capability
- Dedicated hardware
- Use of FAA networks



NIEC Physical Layout

The physical layout of the NIEC consists of the NIEC Display Area (NDA) and the NIEC Support Room.





NDA: ATM Area

The ATM area simulates en route and terminal domains and includes both existing and future NextGen capabilities



ATM Area [2]



NDA: Tower Area

The Tower area contains workstations and functions that represent both current and NextGen capabilities. The Tower area includes a 180 degree video depiction of aircraft and simulated airport operations and surface management capabilities.



Tower Area [2]



NDA: RCS Area

Research Cockpit Simulator (RCS), currently powered by Microsoft Flight Simulator, is a full size, enclosed, configurable and extendable glass cockpit with 220 degree field of view Out the Window (OTW) visualization system that provides visualization of traffic, weather, and over 18,000 airport environments



RCS Area [2]



NDA: MPA Area

The Multi-Purpose Area (MPA) contains an Airline Operations Center (AOC), the simulation control station for experiment configuration, start up, and shut down, partial integration with the Tower area to support tower operations, and displays of live data feeds



NDA: UAS Area

UAS area includes simulation software for 3 medium to high-fidelity UASs and some actual and other hardware for the Ground Control Station (GCS) of each UAS. This area also includes other supporting capabilities such as FMS and CDTI.



NIEC Infrastructure

Capabilities

NIEC Support Capabilities

Recording and
Playback

Simulation
Control

NAS Capabilities

ATM
Systems

ATM Emulations,
Simulations, Prototypes

Primary Interfaces Between Capabilities

TGF

HADDs

DESIREE

SWIM-Like Capabilities

Networks

FAA WJHTC Lab Network

FAA DMZ

Internet

Data

Simulated Operational Data

Adaptation Data

Live Feeds

Other Data



Capabilities

ATM area

En Route Automation Modernization (ERAM)
Display System Replacement (DSR)
User Request Evaluation Tool (URET)/Joint En Route Decision Support System Infrastructure (JEDI)
Electronic and paper flight strip
Standard Terminal Automation Replacement System (STARS)
TFM Display (in ATM Suite)
FEWS
ERAM Evaluation System (EES)

Tower area

FTWS
Tower, OTW, Virtual Airport Immersion Environment (VAIE)
Tower Operations and Digital Data Systems (TODDS)
TFDM: Tower Information Display System (TIDS)
TFDM: FDM
TFDM: Clearance Delivery Pre-Departure
Digital Bright Radar Indicator Tower Equipment (DBRITE)
Airport Surface Detection Equipment Model – X (ASDE-X)
REHOST

UAS area

RQ-7B Shadow-200 Simulator
MQ-9 Predator B Simulator
ScanEagle
UAS/CDTI
FMS
Boeing 737 User Interface Powered By GE FMS
Analytical Graphics, Inc. (AGI) Satellite Took Kit (STK)

RCS area

RCS
CDTI
Electronic Flight Bag

MPA area

TFMS
TBFM
SWIM ITWS
Weather and Radar Processor (WARP)
Consolidated Storm Prediction for Aviation (CoSPA) /CIWS
Route Availability Planning Tool (RAPT)
ITWS
AOC

General Services

TGF
HADDS
DESIREE
DATAComm
Flight Database
Adaptation Database
Automatic Dependent Surveillance-Broadcast (ADS-B)/TIS-B/FIS-B/radar surveillance

Data Collection and Sim Control

Data Collection Capability
WAK
Easy Button
Push-to-Talk
REVUE
Simulation Management and Control

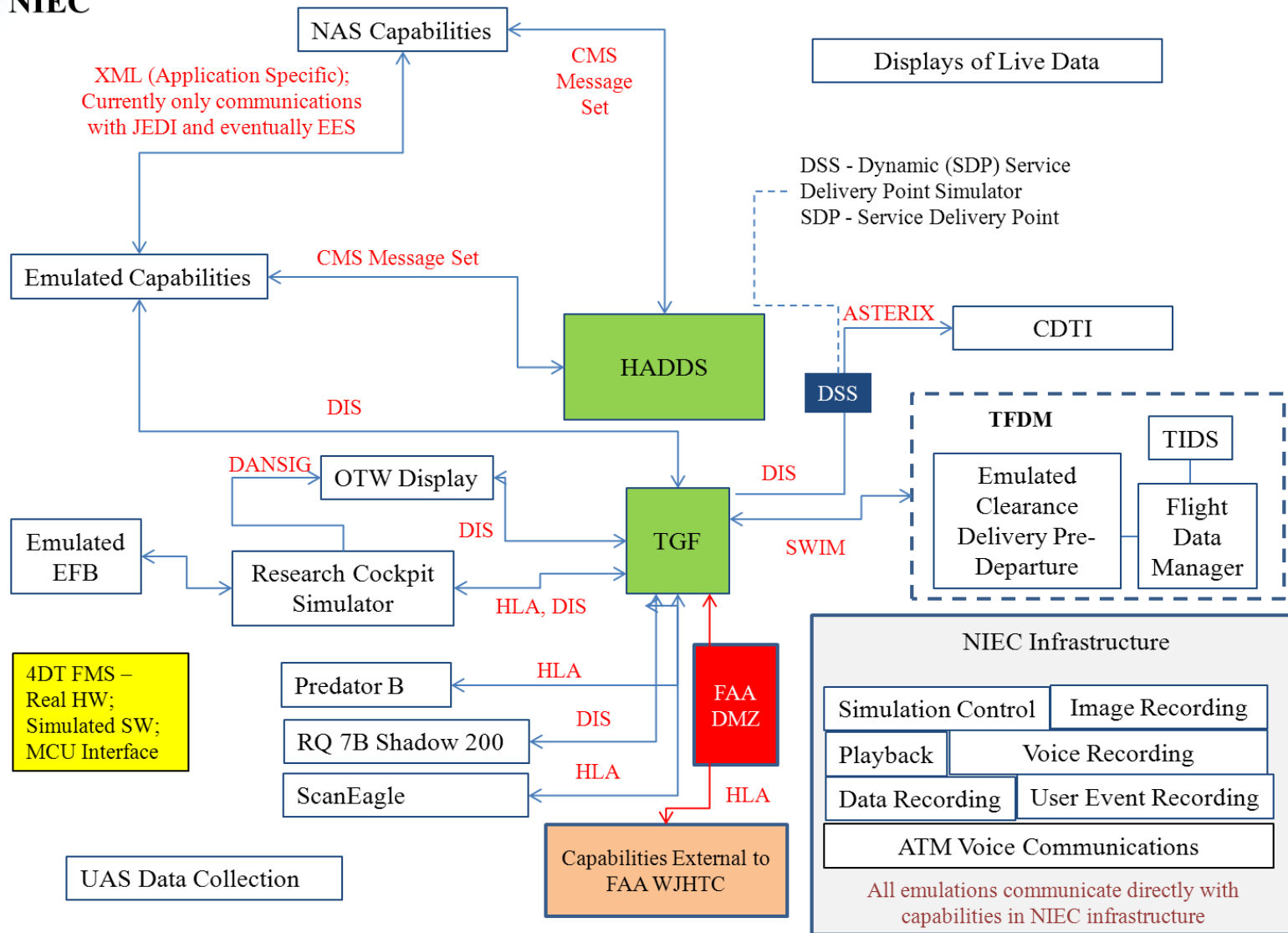
Voice Comm

ATC voice communications: Interim Voice Response System



Primary Interfaces Between Capabilities (2 of 2)

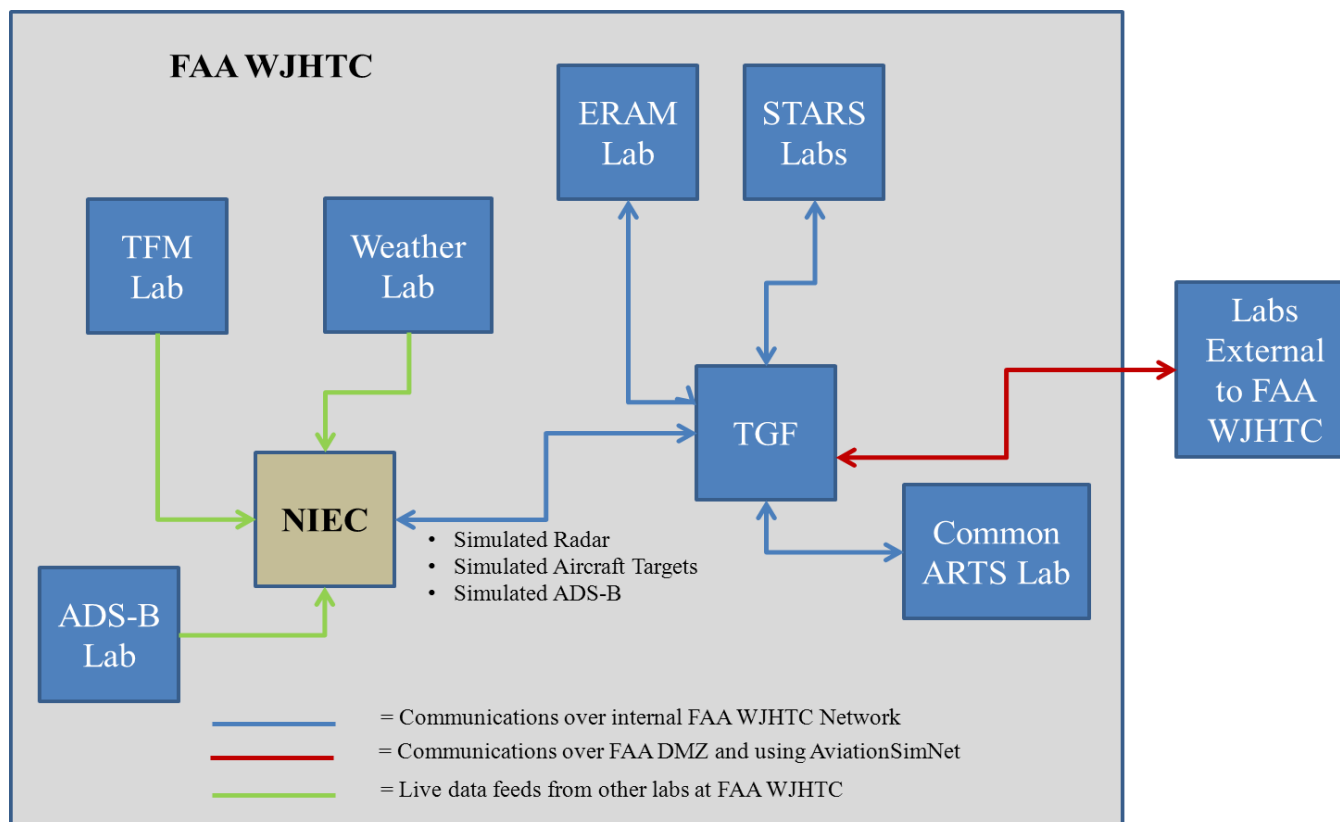
NIEC





Networks (1 of 2)

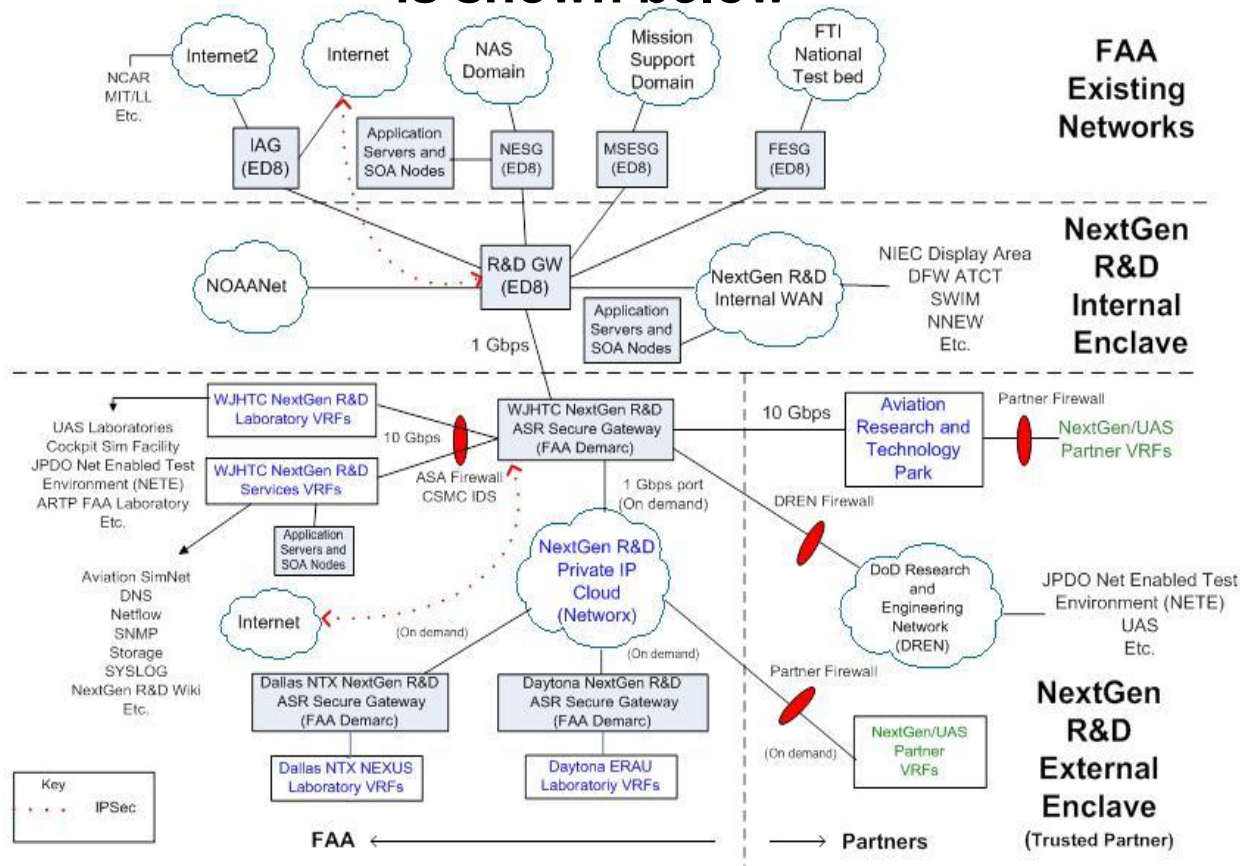
- The NIEC is often thought of as the physical location of the NIEC Display Area (NDA) and NIEC Support Room at the FAA WJHTC. Although the walls around the NIEC are physical, they do not bind the network and extensibility of the NIEC and the capabilities with which it can interface.





Networks (2 of 2)

The NIEC resides on the FAA internal lab network and on the FAA R&D external Enclave. However, a futuristic view of the R&D enclave is shown below



Future Notional NextGen R&D Domain [4]



Data

- **The NIEC utilizes live feeds, simulated operational data, adaptation data, and other data sources for simulations.**
- **The NIEC interfaces with many systems at the FAA WJHTC, as well as with systems external to the FAA WJHTC, either directly or indirectly to obtain the data.**
- **The data used during project execution is determined by the customer and the NIEC capability to provide the data.**



Data

Live Data Feeds

Data	Consumers
Aircraft Situation Display to Industry (ASDI)	MPA TBM
Automatic Dependent Surveillance – Broadcast (ADS-B)	MPA RSC UAS
Flight Information Service – Broadcast (FIS-B) Services	MPA RSC UAS
Traffic Information Service – Broadcast (TIS-B) Services	MPA RCS UAS
National Weather Service (NWS)	MPA UAS
NextGen Network Enabled Weather (NNEW) Service	MPA UAS
Weather Service International (WIS)	MPA RCS UAS
Weather and Radar Processor (WARP) Service	MPA RCS UAS

Simulated Operational Data

Data	Consumer
Airport Surface Detection Equipment -Model X (ASDE-X) Services	MPA TowerUAS
ADS-B	ATM MPA UAS Tower RCS
HOST Air Traffic Management Data Distribution System (HADDSS)	ATM Tower MPA
System Wide Information Management (SWIM)	ATM MPA Tower (TFDM)
Target Generation Facility (TGF)	En Route Tower MPA UAS Research Cockpit Simulator
Traffic Management Advisor (TMA)	ATM MPA

Adaptation Data

Data	Consumers
ACES Adaptation	ATM Tower MPA UAS
ASDE-X Adaptation	Tower
URET Adaptation	ATM
ERAM Adaptation	ATM
TFM Adaptation	ATM Tower MPA
STARS Maps	Tower MPA

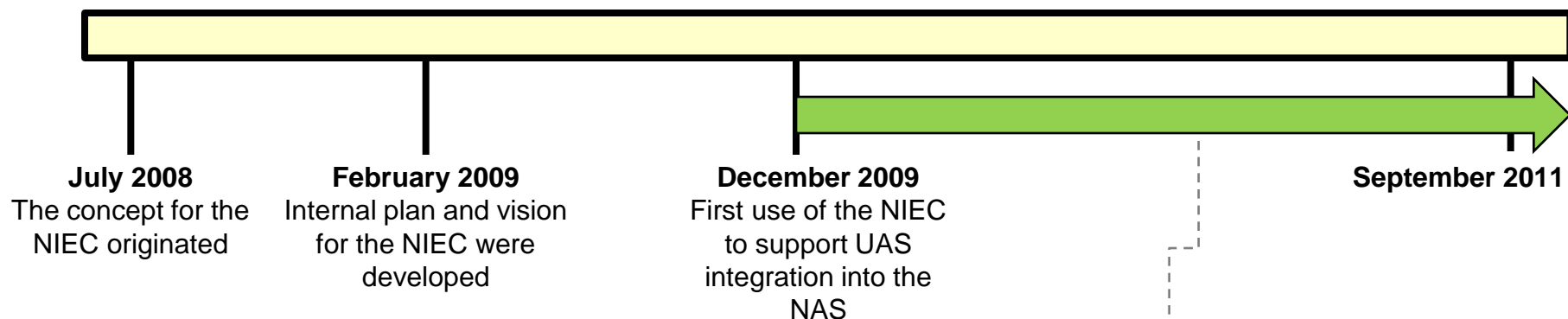
Other Data

Data	Consumers
Web Weather Services	Cockpit out the window Tower display
Military Flight Data	UAS DESIREE TGF



NIEC Projects (Past and Currently Planned)

The NIEC has already supported numerous projects to aid in NextGen research and continues to be used to answer NextGen research questions



- Numerous projects have been conducted on a regular basis, several of which have lasted for a few months and several more are planned for the remainder of 2011 and into 2012.
- The number of planned projects continues to grow as FAA programs become aware of the capabilities in the NIEC, the extensibility of the NIEC, and how the NIEC can meet their needs



NIEC Projects (Past and Currently Planned)

Month/Year	Title
12/2009	AAI's RQ7 Shadow Simulator (SP) Achieved Performance Model Verification
05/2010	GA Pred B Simulator Achieve Performance Model Verification
2/2010 – 5/2010 1/2011	Staffed NextGen Tower 1.0 Staffed NextGen Tower 1.5
12/2010	Mini INI
3/2011	Demo-1SE: ScanEagle Achieved Performance Model Verification
5/2011	4D FMS TBO
08/ 2011 – 9/2011	UAS NAS Integration: lost link assessment
6/2011 12/2011	UAS NextGen Demonstration 4 HITL Field flight
6 – 7/2011	SNT HITL 2.0
August 2011	Multi-UAS Operational Assessment: Victorville, California
September 2011	Net Enabled Operations (NEO) Demonstration 5
10/2011 - 11/2011	NEO Demonstration 6
11/2011	Ground Based Augmentation System (GBAS) Project Newark
Tentative 2011/2012	DataComm MCDU Integration
Schedule is TBD due to funding.	Weather Technology in the Cockpit (WTIC)



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Future Use of the NIEC for NextGen Research



Future Use of the NIEC for NextGen Research Overview

- **Goal:**
 - To identify potential candidates for future research to be conducted at the NIEC
- **Method:**
 - Analyze NextGen operational concepts to identify specific areas for potential research to be conducted at the NIEC
 - NextGen Mid-term Operational Scenarios
 - NextGen Segment Implementation Plan (NSIP) for 2010–2015 (Alpha)
 - Capabilities for 2016-2018 and beyond (Segment Bravo and Charlie)
 - Identify components/characteristics of the NIEC to support NextGen concept development
 - Identify gaps in capabilities – what may be needed and when

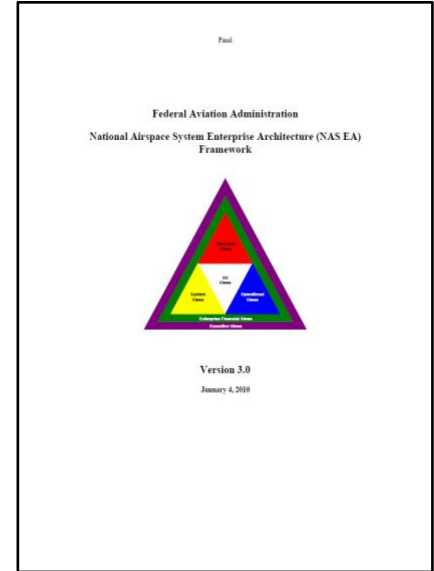
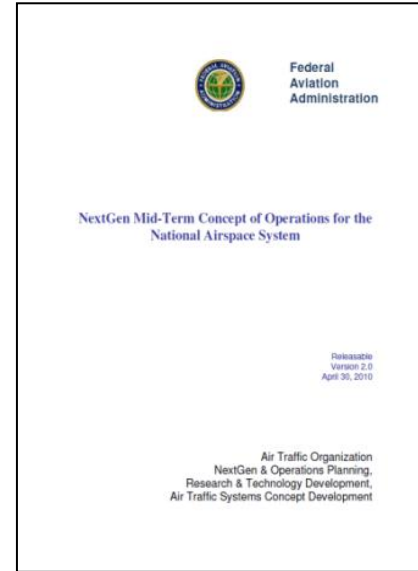
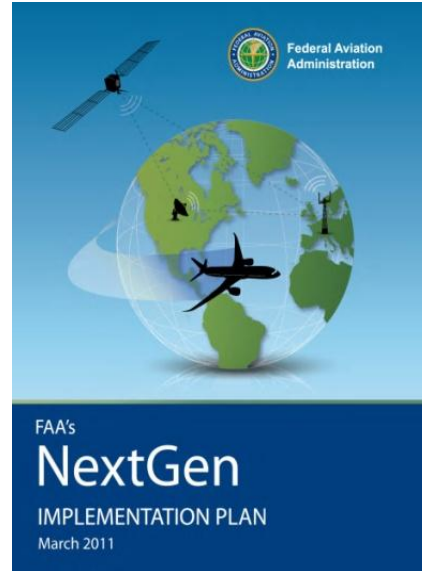


Future Use of the NIEC for NextGen Research Topics

- **NextGen Mid-Term Concept Development**
 - **NextGen Documentation**
 - NGIP, Mid-Term Conops, NAS EA
 - **NextGen Mid-term Operational Concept Development**
 - NSIPs, Operational Scenarios
- **Process for Identifying Research Areas that the NIEC can support**
- **Potential Candidates for Research Areas that the NIEC can Support**
 - Includes operational description, NIEC capabilities to support and gaps, research topics
- **Evolution of the NIEC**
 - Capabilities needed to be developed or obtained, and projected timeframes to support for future NextGen research



NextGen Mid-Term Concepts Development Documentation



NextGen Solution Sets and Operational Improvements [5]

- 12 Solution Sets describing Operational Improvements (OIs)
- An OI represents a discrete strategic activity for service delivery to improve NAS operations and move towards the NextGen vision.

NextGen Implementation Plan (NGIP) [6]

- Yearly plan and status of NextGen to stakeholders

NextGen Mid-Term Concept of Operations [7]

- Operational view of all phases of flight in the NextGen mid-term

NAS Enterprise Architecture (NAS EA) [8]

- Mechanism for developing functional requirements
- Includes Operational Views (OVs) and System Views (SVs)



Ongoing NextGen Mid-Term Operational Concept Development



Mid-Term Operational Scenarios (OV-6c)

- 26 scenarios that describe operations at the end of the mid-term (2018) [9]
 - High-level operational concepts (OV-1)
 - Operational thread
 - Sequence diagrams showing system/human interactions
 - Concept Issues and gaps
- Off-nominal scenarios under development

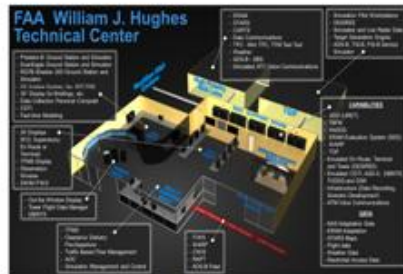


NextGen Segment Implementation Plans (NSIPs) [10]

- Segment Alpha: 2010-2015
 - 8 portfolios that describe specific capabilities or increments for subsets of OIs plus Common Services
 - Success criteria and benefits
 - Implementation schedules and challenges
- Segment Bravo: 2016-2018
 - Increment definition and feasibility analysis ongoing
 - Reallocation beyond 2018 (Segment Charlie)



Process for Identifying Research Areas that the NIEC can Support



Current Profile of the NIEC



Mid-Term Operational Scenarios (OV-6c)



NextGen Segment Implementation Plans (Alpha, Bravo, etc.)

Decompose NextGen mid-term concepts

- Suitability for simulation
- Maturity, priority, and implementation timeframe
- Domains, systems, functions, equipment, research questions
- Compare with NIEC capabilities and identify gaps

Identify potential research areas that can be conducted at the NIEC

- Types (categories) of NAS operations or operational threads
- Specific research topics
- Focus on multi-domain operations, NIEC physical and functional capabilities, and WJHTC interfaces and personnel expertise

Document how the NIEC is well-suited to support the research area

- Describe the operation/research area
- Describe NIEC areas, equipment, and interfaces that can be used
- Identify additional capabilities that may be needed to support them



Potential Candidates for Research Areas that the NIEC can Support

- **Research Areas**
 - Surface Operations
 - Arrival Flows
 - Departure Sequencing
 - Low Visibility Operations
 - Traffic Flow Management
 - Cruise Operations
 - Other
- **Descriptions of each Research Area includes:**
 - Operational description
 - NIEC functional areas and components that can be used
 - Gaps in NIEC capabilities
 - Research topics



Surface Operations - Summary

Objectives	NIEC Areas/Components	Primary OIs Addressed	Additional NIEC Capabilities Needed (Projected Timeframe)
Evaluate equipment, decision support systems, and operational procedures to increase the efficiency of surface operations, reduce runway incursions, and increase safety	<u>Tower</u> <ul style="list-style-type: none"> OTW TFDM DBRITE <u>RCS</u> <ul style="list-style-type: none"> CDTI EFB (available early FY12) <u>MPA</u> <ul style="list-style-type: none"> AOC <u>Data</u> <ul style="list-style-type: none"> TGF ASDE-X <u>ATM – Terminal (optional)</u> <ul style="list-style-type: none"> STARS 	<ul style="list-style-type: none"> Improved Runway Safety Situational Awareness for Controllers (103207) Improved Runway Safety Situational Awareness for Pilots (103208) Initial Surface Traffic Management (104209) Enhanced Surface Traffic Operations (OI 104207) 	<p>SURF-IA (2014)</p> <p>Emulation and workstations for local and government agencies (2012-2016)</p> <p>TAMR (2013)</p> <p>SWIM Segment 1</p> <ul style="list-style-type: none"> Runway visual range publication Terminal Data Distribution publication



Arrival Flows - Summary

Objectives	NIEC Areas/Components	Primary OIs Addressed	Additional NIEC Capabilities Needed (Projected Timeframe)
Evaluate automation and procedures that support arrival flow management and specific arrival procedures under different operational conditions.	<u>ATM - Terminal</u> <ul style="list-style-type: none"> STARS <u>RCS</u> <ul style="list-style-type: none"> CDTI EFB (available early FY12) <u>MPA</u> <ul style="list-style-type: none"> TFMS Mini-TPC AOC <u>Tower</u> <ul style="list-style-type: none"> OTW TFDM DBRITE <u>Data</u> <ul style="list-style-type: none"> TGF ASDE-X ADS-B (TIS-B FIS-B) 	<ul style="list-style-type: none"> Point-in-Space Metering (OI 104120) Time-Based Metering using RNAV and RNP Route Assignments (OI 104123) Automation Support for Separation Management (OI 102137) Increase Capacity and Efficiency using RNAV and RNP (OI 108209) Improved Management of Arrivals/Surface/Departure (A/S/D) Flow Operations (OI 104117) Time Based Metering in the Terminal Environment (OI 104128) 	<p>TAMR (2013)</p> <p>Mini-TPC (2012 – planned) and/or interface to WJHTC TPC test environment</p> <p>ATPA (2011 – planned)</p> <p>Emulation and workstations for local and government agencies (2012-2016)</p> <p><u>SWIM Segment 1</u></p> <ul style="list-style-type: none"> Runway visual range publication Terminal Data Distribution publication



Departure Sequencing - Summary

Objectives	NIEC Areas/Components	Primary OIs Addressed	Additional NIEC Capabilities Needed (Projected Timeframe)
Evaluate ground and aircraft equipment and decision support tools that are being developed to assist departure sequencing from the ground and merging aircraft into flows, once airborne.	<u>Tower</u> <ul style="list-style-type: none"> OTW TFDM DBRITE <u>ATM - Terminal</u> <ul style="list-style-type: none"> STARS <u>MPA</u> <ul style="list-style-type: none"> AOC <u>RCS</u> <ul style="list-style-type: none"> Integrated FMS <u>Data</u> <ul style="list-style-type: none"> TGF Weather (Live/simulated) ASDE-X ADS-B (TIS-B FIS-B) 	<ul style="list-style-type: none"> Improved Management of Arrivals/Surface/Departure (A/S/D) Flow Operations (OI 104117) Provide Full Flight Plan Constraint Evaluation with Feedback (OI 101102) Enhanced Surface Traffic Operations (OI 104207) Initial Surface Traffic Management (OI 104209) Wake Turbulence Mitigation for Departures (WTMD) (OI 102140) 	<p>TAMR (2013)</p> <p><u>SWIM Segment 1</u></p> <ul style="list-style-type: none"> Runway visual range publication Terminal Data Distribution publication



Low Visibility Operations - Summary

Objectives	NIEC Areas/Components	Primary OIs Addressed	Additional NIEC Capabilities Needed (Projected Timeframe)
Evaluate tools, equipment, and procedures to assist arrivals, departures, and surface operations under reduced visibility conditions	<u>Tower</u> <ul style="list-style-type: none"> OTW TFDM DBRITE <u>ATM - Terminal</u> <ul style="list-style-type: none"> STARS <u>RCS</u> <ul style="list-style-type: none"> Integrated FMS CDTI EFB (available early FY12) <u>Data</u> <ul style="list-style-type: none"> TGF Weather (Live/simulated) ASDE-X ADS-B (TIS-B FIS-B) 	<ul style="list-style-type: none"> Low Visibility Surface Operations (OI 107202) Low Visibility/Ceiling Takeoff Operations (OI 107115) Low Visibility/Ceiling Approach Operations (OI 107117) Expanded Low Visibility Operations Using Lower Runway Visual Range (RVR) Minima (OI 107119) Low Visibility/Ceiling Landing Operations (OI 107118) 	<p>Enhanced or Synthetic Vision System (2012)</p> <p>TAMR (2013)</p> <p><u>SWIM Segment 1</u></p> <ul style="list-style-type: none"> Runway visual range publication Terminal Data Distribution publication



Traffic Flow Management - Summary

Objectives	NIEC Areas/Components	Primary OIs Addressed	Additional NIEC Capabilities Needed (Projected Timeframe)
Evaluate new tools for predicting and resolving flow problems and how information is disseminated from the TFMS to various stakeholders	<u>MPA</u> <ul style="list-style-type: none"> TFMS AOC <u>Tower</u> <ul style="list-style-type: none"> OTW TFDM DBRITE <u>ATM - En Route</u> <ul style="list-style-type: none"> ERAM <u>ATM - Terminal</u> <ul style="list-style-type: none"> STARS <u>Airport Systems</u> <ul style="list-style-type: none"> ASDE-X <u>RCS</u> <ul style="list-style-type: none"> Integrated FMS <u>Data</u> <ul style="list-style-type: none"> TGF Weather (Live/Simulated) 	<ul style="list-style-type: none"> Traffic Management Initiatives with Flight Specific Trajectories (OI 105208) Continuous Flight Day Evaluation (OI 105302) Initial Integration of Weather Information into NAS Automation and Decision Making (OI 103119) Provide Full Flight Plan Constraint Evaluation with Feedback (OI 101102) Initial Improved Information from Non-Ground Based Sensors (OI 103116) On-Demand NAS Information (OI 103305) 	<p>Mini-TPC (2012 – planned) and/or interface to WJHTC TPC test environment</p> <p>TAMR (2013)</p> <p><u>SWIM Segment 1</u></p> <ul style="list-style-type: none"> Flow Information Publication Reroute data exchange publication



Cruise Operations – Summary

Objectives	NIEC Areas/Components	Primary OIs Addressed	Additional NIEC Capabilities Needed (Projected Timeframe)
Evaluate planned improvements to ground and airborne capabilities to support operations in terminal, en route, and oceanic airspace	<u>ATM - En Route</u> <ul style="list-style-type: none"> • ERAM <u>ATM - Terminal</u> <ul style="list-style-type: none"> • STARS <u>ATM - Oceanic</u> <ul style="list-style-type: none"> • ATOP (connect to ATOP lab) <u>MPA</u> <ul style="list-style-type: none"> • TFMS • AOC <u>RCS</u> <u>Data</u> <ul style="list-style-type: none"> • TGF • Weather (Live/ Simulated) • ADS-B (TIS-B FIS-B) 	<ul style="list-style-type: none"> • Automation Support for Separation Management (OI 102137) • Initial Conflict Resolution Advisories (OI 102114) • Increase Capacity and Efficiency using RNAV and RNP (OI 108209) • On-Demand NAS Information (OI 103305) • Continuous Flight Day Evaluation (OI 105302) • Initial Integration of Weather Information into NAS Automation and Decision Making (OI 103119) • Delegated Responsibility for In-Trail Separation (102118) 	<p>TGF 4DT Profile (2012 – planned)</p> <p>Integrated FMS</p> <p>TAMR (2013)</p> <p><u>SWIM Segment 1</u></p> <ul style="list-style-type: none"> • Flight data publication • Flow information publication



Other Research Areas

- **Examples of other concepts or operational situations**
 - **Common Services (e.g., Weather)**
 - **UAS Operations**
 - **Staffed NextGen Towers**
 - **Security**
 - **Specific Industry Initiatives**
 - **Specific Research areas**
 - **Specific Operational Situations**



Evolution of the NIEC

- **NIEC can support a large amount of research but may need to expand its assets for specific research topics**
- **Projected needs and timeframes include NIEC plans to develop or pro and additional capabilities are identified**



CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT (CAASD)

Project Life Cycle



NIEC Project Life Cycle

The NIEC Project Lifecycle is described in three parts project initiation, project execution, and project feedback.

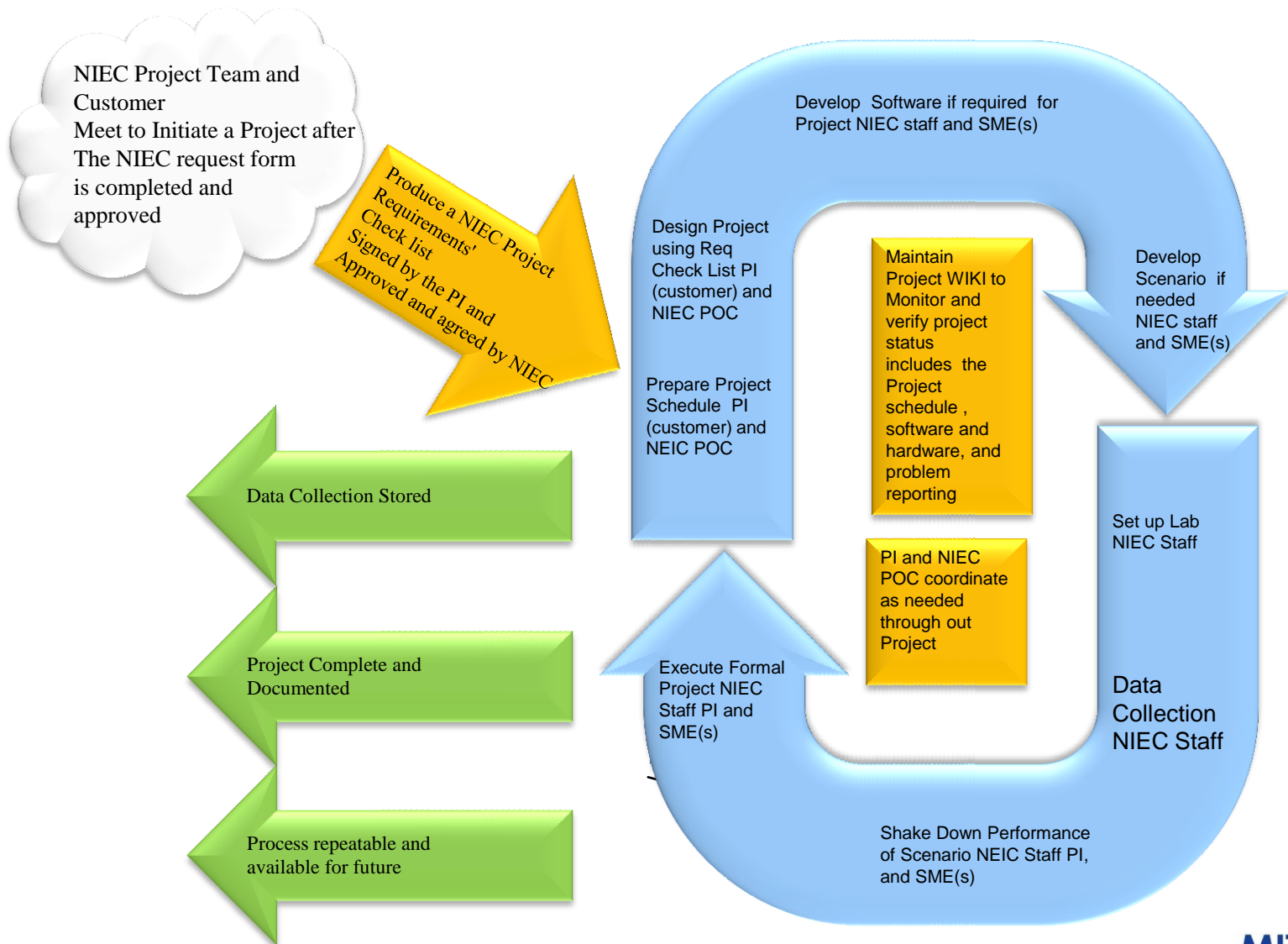
A project is initiated with the NIEC by completing the NIEC Project Request Form (QF-NIEC-01) and submitting the form to the NIEC team.

After the NIEC has reviewed and approved the project. The POC for the project provides the customer with the NIEC Project Requirements Checklist 001.

The NIEC Requirements Revision Form (QF-NIEC-02) must be completed, If at any time during the project life cycle a new requirement is introduced or a requirement is modified



Executing a Project in the NIEC





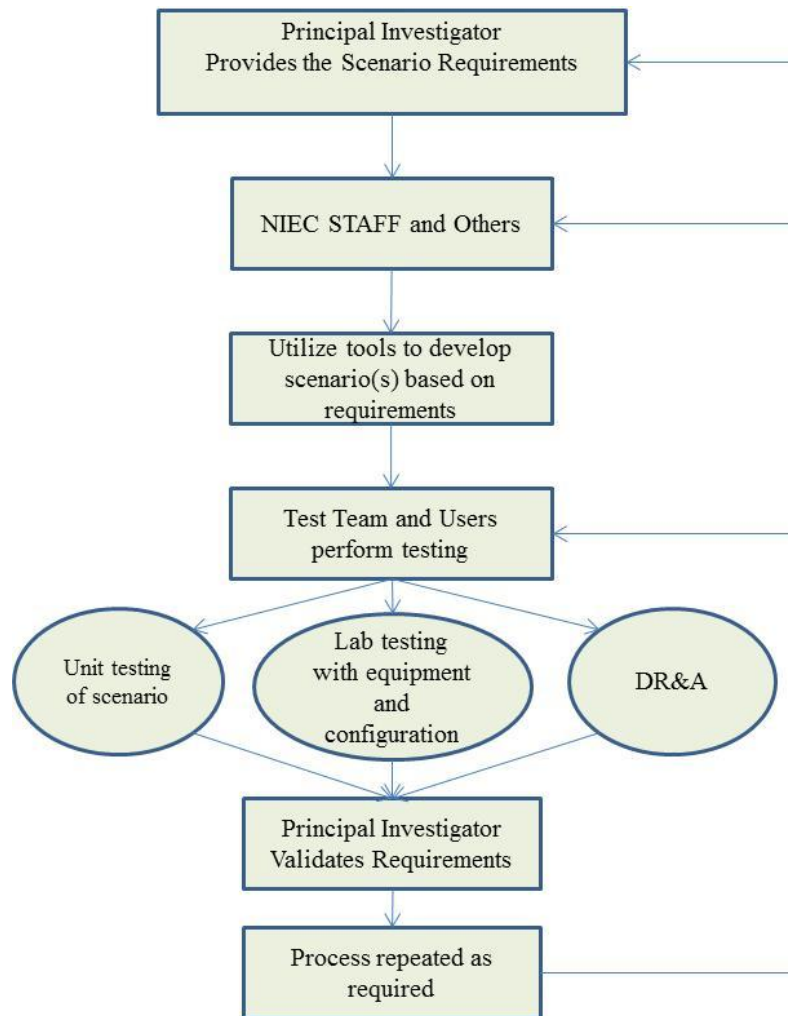
NIEC Project Life Cycle (continued)

- **Experimental Design**
 - The Experimental Design is the responsibility of the project's Principle Investigator (PI) provided by the Customer.
- **Software Development**
 - If the project requires new or modified capabilities, the NIEC staff develops new software or modifies existing software as needed to meet the experimental design goals.



NIEC Project Life Cycle Scenario Development

NIEC Scenario Development is based on project requirements obtained from the NIEC Project Requirements checklist as well as the PI and/or customer.

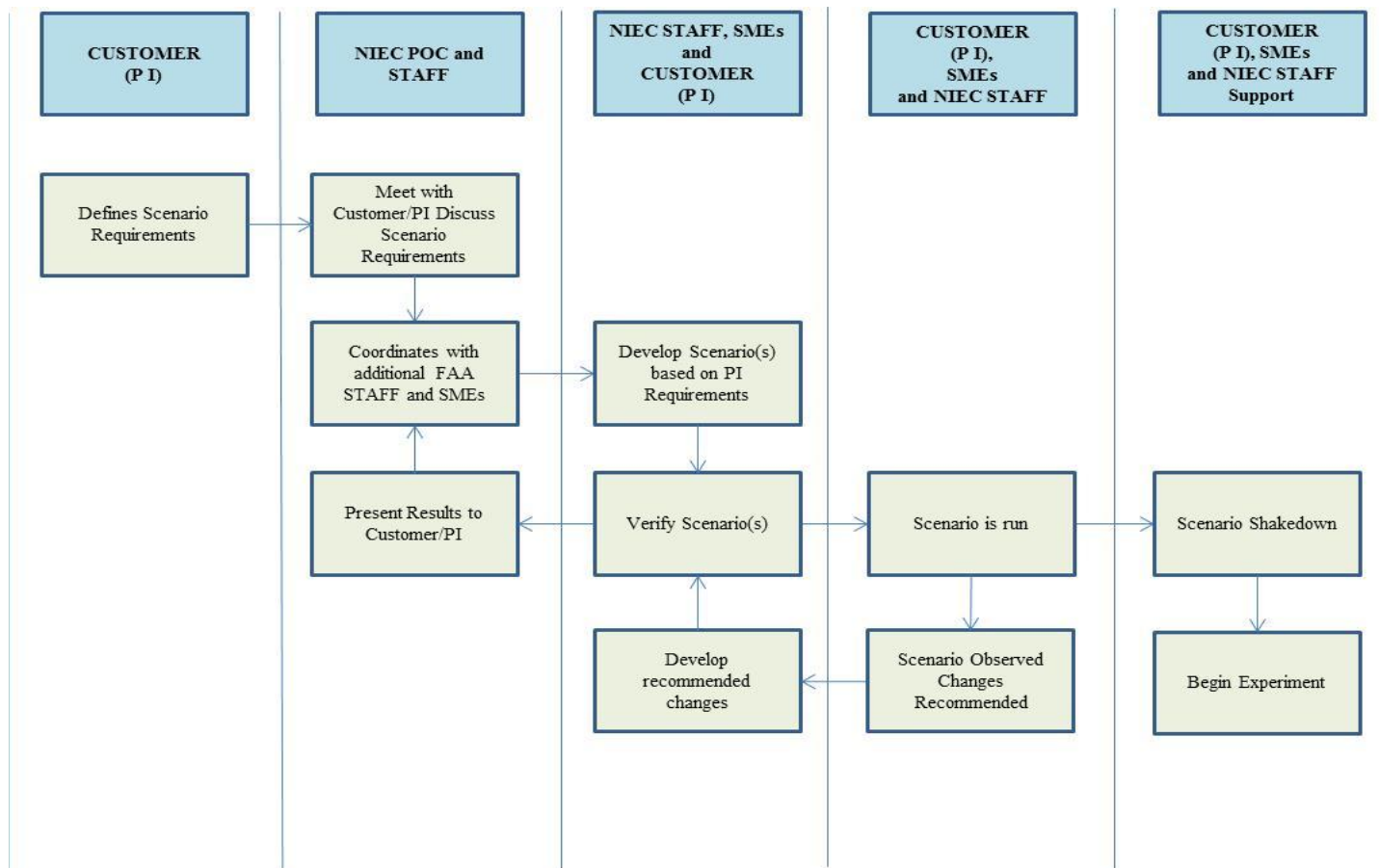


The scenario development may be a team effort with the customer, NIEC staff, and SMEs when required, or the customer may provide the scenario.



Project Life Cycle Scenario Development (continued)

Describes the roles of the various participants involved in the scenario development.





NIEC Project Life Cycle (continued)

- **Lab Configuration** - The NIEC staff configures all required NDA components, which include scenario, voice and video communications.
- **Project Data Collection** - Data to be collected is determined by the Project Requirements Checklist and PI and/or customer. Project
- **Project Execution Shakedown**- During the project execution shakedown, the NIEC staff, as well as the project PI and/or customer and any additional required staff conduct a dry run to validate the procedures, processes, and data collection.
- **Executing the Project**- The formal execution of the project is supported by the project PI and/or customer, NIEC POC, required NIEC staff, and SME(s) when required.



NIEC Project Life Cycle

- **Project Feedback**
 - The NIEC Customer Feedback Form (QF-NIEC-03) is used by the customer to provide the NIEC management and staff with an assessment of their experience using the NIEC to execute their project.
 - The NIEC manager will respond to all concerns documented, in the NIEC Customer Feedback Form.



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Glossary (1 of 3)

4DT	Four-Dimensional Trajectory	DCL	Departure Clearance
A/S/D	Arrivals/Surface/Departure	DESIREE	Distributed Environment for Simulation, Rapid Engineering and Experimentation
ACES	Adaptation Controlled Environment System	DHS	Department of Homeland Security
AGI	Analytical Graphics, Incorporated	DoD	Department of Defense
AIM	Aeronautical Information Management	DR&A	Data Reduction and Analysis
ANSP	Air Navigation Service Provider	DSR	Display System Replacement
AOC	Airline Operations Center	DST	Decision Support Tool
ARTCC	Air Route Traffic Control Center	EA	Enterprise Architecture
ASDE-X	Airport Surface Detection Equipment Model – X	EES	ERAM Evaluation System
ASDI	Aircraft Situation Display to Industry	EFB	Electronic Flight Bag
ATIS	Automatic Terminal Information Service	EFVS	Enhanced Flight Vision System
ATC	Air Traffic Control	ERAM	En Route Automation Modernization
ATCSCC	ATC System Command Center	ERAU	Embry Riddle Aeronautical University
ATM	Air Traffic Management	ETA	Estimated Time of Arrival
ATOP	Advanced Technology and Oceanic Procedures	FAA	Federal Aviation Administration
ATPA	Automated Terminal Proximity Alert	FANS-1A	Future Air Navigation System
CARTS	Common Automated Terminal Radar System	FEWS	Future En Route Work Station
CDTI	Cockpit Display of Traffic Information	FIS-B	Flight Information Service-Broadcast Mode
CMS	Common Message Set	FMS	Flight Management System
CNS	Communication, Navigation, and Surveillance	FTWS	Future Terminal Work Station
CoSPA	Consolidated Storm Prediction for Aviation	GA	General Atomics
CRDA	Collaborative Research and Development Agreement	GBAS	Ground Based Augmentation System
DBRITE	Digital Bright Radar Indicator Tower Equipment	GCS	Ground Control Station



Glossary (2 of 3)

GIM-S	Ground Interval Management – Spacing	NSIP	NextGen Segment Implementation Plan
HADDS	Host ATM Data Distribution System	NWS	National Weather Service
HITL	Human in the Loop	OI	Operational Improvement
HLA	High Level Architecture	OPD	Optimal Profile Descents
ISO	International Organization for Standardization	OTW	Out the Window
ITCZ	Intertropical Convergence Zone	OV	Operational Views
ITWS	Integrated Terminal Weather System	PBN	Performance-Based Navigation
IVSR	Interim Voice Response System	PI	Principle Investigator
JEDI	Joint En Route Decision Support System Infrastructure	POC	Point of Contact
LED	Light Emitting Diode	PRM	Precision Runway Monitor
M&S	Modeling & Simulation	R&D	Research and Development
MIT/LL	Massachusetts Institute of Technology Lincoln Laboratory	RAPT	Route Availability Planning Tool
MPA	Multi-Purpose Area	RCS	Research Cockpit Simulator
NAS	National Airspace System	RNAV	Area Navigation
NCAR	National Center for Atmospheric Research	RNP	Required Navigation Performance
NDA	NIEC Display Area	RTCA	Radio Technical Commission for Aeronautics, Inc.
NEO	Net Enabled Operations	RVR	Runway Visual Range
NextGen	Next Generation Air Transportation System	SAA	Special Activity Airspace
NEXRAD	Next-Generation Weather Radar	SATNAV	Satellite Navigation
NIEC	NextGen Integration and Evaluation Capability	SC	Special Committee
NEW	NextGen Network Enabled Weather	SME	Subject Matter Expert
NOTAM	Notice To Airmen	SNT	Staffed NextGen Tower



Glossary (3 of 3)

STARS	Standard Terminal Automation Replacement System	TMA	Traffic Management Advisory
STK	Satellite Tool Kit	TMC	Traffic Management Coordinator
SURF-IA	Surface Indications and Alerting	TODDS	Tower Operations and Digital Data Systems
SV	System Views	TPC	TFM Production Center
SVS	Synthetic Vision Systems	UAS	Unmanned Aircraft System
SWIM	System Wide Information Management	UFIT	UAS FAA Industry Team
TAMR	Terminal Automation Modernization Replacement	URET	User Request Evaluation Tool
TAP	TFM Auxiliary Platform	VAIE	Virtual Airport Immersion Environment
TBFM	Time Based Flow Management	VDL	VHF Digital Link
TBO	Trajectory Based Operations	WARP	Weather and Radar Processor
TFDM	Tower Flight Data Manager	WJHTC	William J. Hughes Technical Center
TGF	Target Generation Facility	WSR-88D	Weather Surveillance Radar 88 Doppler
TIDS	Tower Information Display System	WTIC	Weather Technology in the Cockpit
TIS-B	Traffic Information Service–Broadcast Mode	XML	eXtensible Markup Language



CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT (CAASD)

Additional Information



NIEC Capabilities

- **The following slides contain a listing of the NIEC capabilities**



NIEC ATM Area Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
AIR TRAFFIC MANAGEMENT AREA			
ERAM	Emulation through FAA Distributed Environment for Simulation, Rapid Engineering and Experimentation (DESIREE) of the same user interface and business logic as NAS ERAM.	FAA	Current and/or Future
DSR	Emulation through DESIREE of the same user interface and business logic as NAS Display System Replacement (DSR).	FAA	Current and/or Future
URET/JEDI	Emulation through DESIREE of the same user interface and business logic as User Request Evaluation Tool (URET) as provided by MITRE through the JEDI prototype. Provides Conflict Probe functionality.	MITRE	Current and/or Future
Electronic and paper flight strip	Emulation through DESIREE that provides flight strips as required	FAA	Current
STARS	Emulation through DESIREE of the same user interface and business logic as NAS Standard Terminal Automation Replacement System (STARS).	FAA	Current and/or Future
TFM Display (in ATM Suite)	Emulation through DESIREE of the same user interface and business logic as NAS Traffic Flow Management (TFM) in beta.	FAA	Current and/or Future
FEWS	Prototype provided through DESIREE of the Future En Route Work Station (FEWS). Provides tools to assist controller in managing high volume traffic safely.	FAA	Future
ERAM Evaluation System (EES)	EES is fielded ERAM hardware and software scaled to fit into a computer rack. Currently integrates with TGF and can be displayed at ATM stations. There is work in-progress for DESIREE-EES integration.	LM for EES FAA for EES Emulation	Future



NIEC Tower Area Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
TOWER AREA			
FTWS	Prototype provided by DESIREE of the Future Terminal Work Station (FTWS). Provides tools to assist controller in managing high volume traffic safely in Terminal airspace. It is built as an extension of ERAM.	FAA	Future
Tower, OTW, VAIE	Tower Out the Window (OTW) or Virtual Airport Immersion Environment (VAIE) provided by the TGF team, which simulates a Tower OTW view.	FAA	Current and/or Future
TODDS	Prototype provided through DESIREE of the Tower Operations and Digital Data Systems (TODDS), an integrated tool to display aircraft location, electronic flight data, and electronic flight strips	FAA	Future
TFDM: TIDS	Prototype provided by Massachusetts Institute of Technology Lincoln Laboratory (MIT LL) of the Tower Flight Data Manager: Tower Information Display System (TFDM: TIDS)	MIT LL	Future
TFDM: FDM	Prototype provided by MIT LL of the Tower Flight Data Manager: Flight Data Management (TFDM:FDM) (Electronic Flight Strips)	MIT LL	Future
TFDM: Clearance Delivery Pre-Departure	Prototype provided by MIT LL of the Tower Flight Data Manager: Clearance Delivery Pre-Departure	MIT LL	Current and/or Future
DBRITE	Emulation through DESIREE STARS of the Digital Bright Radar Indicator Tower Equipment (DBRITE)	FAA	Current
ASDE-X	Emulation through DESIREE of the same user interface and business logic as NAS Airport Surface Detection Equipment Model – X (ASDE-X)	FAA	Current and/or Future
REHOST	Emulation through DESIREE of the same user interface and business logic as REHOST. REHOST is a system that will rebroadcast host data within the tower environment; it is used for situation awareness in the tower similar to the DBRITE	FAA	Current



NIEC MPA Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
MULTI-PURPOSE AREA			
TFMS	Traffic Flow Management System display	FAA	Current and/or Future
TBFM	Traffic Based Flow Management	FAA	Current and/or Future
SWIM ITWS	NAS System Wide Information Management (SWIM) Integrated Terminal Weather System (ITWS) data displayable via DESIREE. <i>NIEC is currently in approval process to subscribe to additional SWIM Segment 1 services.</i>	FAA	Current and/or Future
WARP	Real time live feed of live or recorded Weather and Radar Processor (WARP) data recorded and synchronized with Traffic Generation Facility (TGF) & DESIREE systems for use with simulations.	FAA	Current and/or Future
CoSPA/CIWS	Real time live feed of Consolidated Storm Prediction for Aviation (CoSPA) weather and Corridor Integrated Weather System (CIWS).	N/A	Current and/or Future
RAPT	Real time live feed of Route Availability Planning Tool (RAPT).	N/A	Current and/or Future
ITWS	Real time live feed of Integrated Terminal Weather System (ITWS).	N/A	Current and/or Future
AOC	The AOC Dispatcher position is designed on two 30-inch monitors. It can connect to any simulation running in the NIEC and is fully integrated with DESIREE, integrated with TGF for targets, and integrated with voice and DATACOMM. <i>Future plans include a high-fidelity representation including all current capabilities of the system today.</i>	FAA	Flexible Configuration



NIEC RCS Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
RESEARCH COCKPIT SIMULATOR			
Research Simulator Cockpit (RCS)	Custom-made glass cockpit using COTS and FAA software with Microsoft (MS) Flight Simulator, DANSIG graphics engine (provided by FAA) and TGF.	FAA	Current and/or Future
CDTI	CDTI provided by Garmin GMX 200 with FAA developed software used in conjunction with ADS-B, TIS-B, and FIS-B data.	FAA	Current and/or Future
Electronic Flight Bag	Electronic information management device that helps flight crew perform flight management tasks. It is intended to replace paper charts and automate functions calculated by hand. Currently simulated planned. Waiting on delivery of Class A Astronautics NEXIS EFB already purchased.	FAA	Future



NIEC UAS Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
UNMANNED AIRCRAFT SYSTEMS			
RQ-7B Shadow-200 Simulator	The Shadow 200 is a UAS 6DoF Human in the Loop (HITL) Simulator provided by AAI-Textron Systems that replicates flights in the NAS with a pilot & 'co-pilot' at the controls.	AAI-Textron	Current and/or Future
MQ-9 Predator B Simulator	MQ-9 Predator B, provided by General Atomics (GA-ASI), is a UAS 6DoF HITL Simulator that replicates flight in the NAS with a pilot & 'co-pilot' at the controls.	General Atomics	Current and/or Future
ScanEagle	ScanEagle provided by Insitu- Boeing is a UAS 6DoF HITL Simulator that replicates flight in the NAS with a pilot at the controls.	Boeing	Current and/or Future
UAS/CDTI	CDTI provided by Garmin GMX 200 with FAA developed software used in conjunction with ADS-B, TIS-B, and FIS-B data for UAS Simulators	FAA	Current and/or Future
FMS	Flight Management Simulator provided by GE Aviation Systems integrated with UAS simulators (AAI Shadow 200 presently)	GE Aviation Systems	Current and/or Future
Boeing 737 User Interface Powered By GE FMS	Flight Management System Simulator provided by GE Aviation Systems integrated with Sim Pilot Stations.	GE Aviation Systems	Current and/or Future
Analytical Graphics, Inc (AGI) Satellite Took Kit (STK)	AGI's STK is a Modeling & Simulation (M&S) macro level software tool used for Fast-Time M&S and analysis of scenarios (e.g., UAS, NAS) within the NAS to support the FAA NextGen, Operations Planning / Research & Technology Development groups and Radio Technical Commission for Aeronautics (RTCA) Special Committee (SC) 203. Capabilities include: Predicting air-to-ground Communication performance, 3D visualization, Airspace Analysis, terrain and vehicle conflicts, etc.	FAA	Current and/or Future



NIEC General Services Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
GENERAL SERVICES			
Target Generation Facility (TGF)	The TGF is a Dynamic Real-Time Air Traffic Simulation prototyping capability designed to generate realistic aircraft trajectories and associated digital radar messages for aircraft in a simulated NAS airspace environment. Flight dynamics and targets include General Aviation (GA), Commercial, Military, RCS, & UAS aircraft.	FAA	Current and/or Future
HADDs	Host ATM Data Distribution System (HADDs) is a peripheral En Route Automation Modernization (ERAM) system that supports communications between NAS systems.	FAA	Current and Near-Term Future
DESIREE	NAS prototype providing much of the NAS system functionality for the various domains including tower, terminal, en route and ancillary functionality such as AOC and TFM; Also supports NAS system interfaces, ingestion of NAS adaptation data, emulated graphical user interfaces for ATC systems, various tracker capabilities (such as mosaic, fusion and single sensor), replay of weather data, DATAcomm, alerting and conformance, 4D trajectories, and more.	FAA	N/A
DATAcomm	Emulation of DATAcomm including CPDLC 1A, Segment 1 and partial Segment 2 provided by DESIREE and TGF.	FAA	Future NAS
Flight Database	Generation of flight plans from ASDI. Available in both TGF and DESIREE.	FAA	Current
Adaptation Database	NAS and other adaptation	FAA	Current
Automatic Dependent Surveillance-Broadcast (ADS-B)/TIS-B/FIS-B/radar surveillance	Simulated and actual surveillance data available for display including ADS-B, Traffic Information Service – Broadcast Mode (TIS-B), Flight Information Service (FIS-B) and radar surveillance.	Not Applicable	Not Applicable



NIEC Voice Communications Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
VOICE COMMUNICATIONS			
ATC voice communications: Interim Voice Response System	Fielded voice switch, the Interim Voice Response System (IVSR), for use during HITL simulations for both voice communications and voice recording. Note that this voice system can tie into other custom software-based voice systems at the FAA WJHTC such as the voice system in the TGF.	FAA	Current



NIEC Simulation Support Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
DATA COLLECTION			
Data Collection Capability	Data provided by DESIREE, TGF, cameras, and the voice communication system. All are time synchronized for playback and data analysis. Extensive data collection capabilities (audio, video, data); Cameras for observation and video recording; Audio recording (both on frequency and ambient) Workload Assessment data; Capability for controllers to record when operational anomalies have been recognized.	FAA	N/A
WAK	Workload Assessment Keypad, a participant workload assessment device.	FAA	Not Applicable - Used in human in the loop simulations
Easy Button	Used to gather information on cognitive response from time of off-nominal event until time controller hits Easy Button	FAA	N/A – used to collect metrics during HITL
Push-to-Talk	Used to collect information on clicks per workstation	FAA	N/A – used to collect metrics during HITL
REVUE	An ATC DVR and replay software used to record and replay, respectively, PCF formatted data collected on a per controller workstation basis. Displays can be replayed anywhere.	EIZO	N/A



NIEC Simulation Support Capabilities

Capability	Description	Point of Contact to Extend Functionality	Current or Future NAS Functionality
SIMULATION MANAGEMENT AND CONTROL			
Simulation Management and Control	Simulation start, stop, control and set-up.	FAA	N/A



Live Data Feeds

Data	Description	Consumers
Aircraft Situation Display to Industry (ASDI)	<p>The ASDI stream consists of data elements which show the position and flight plans of all aircraft in NAS.</p> <p>Live data is available from FAA server through publish /subscribe mechanism in XML format.</p>	<p>MPA</p> <p>TBM</p>
Automatic Dependent Surveillance – Broadcast (ADS-B)	<p>ADS-B services is a surveillance technology for tracking aircraft as part of the NextGen. Live data available from ITT server through publish / subscribe mechanism in Asterix Category 33 (Version 2) format.</p>	<p>MPA</p> <p>RSC</p> <p>UAS</p>
Flight Information Service – Broadcast (FIS-B) Services	<p>The FIS-B Service provides weather text, weather graphics, Notice To Airmen (NOTAMs), Automatic Terminal Information Service (ATIS), and similar information.</p> <p>Live data is available from ITT server through publish / subscribe mechanism in DO-267A format.</p>	<p>MPA</p> <p>RSC</p> <p>UAS</p>
Traffic Information Service – Broadcast (TIS-B) Services	<p>TIS is an addressed ground-to air service that provides automatic traffic advisories via addressed Comm A messages using the Mode S data link.</p> <p>Live data available from ITT server through publish / subscribe mechanism in Asterix Category 33 (Version 2) format.</p> <p>Archived data available from Surveillance Broadcast Services System through publish / subscribe mechanism in Asterix Category 33 (Version 1) format.</p>	<p>MPA</p> <p>RCS</p> <p>UAS</p>
National Weather Service (NWS)	<p>The NWS provides weather, hydrologic, and climate forecasts and warnings for the United States.</p> <p>Live data is available from ERAU through publish / subscribe mechanism in multiple formats.</p>	<p>MPA</p> <p>UAS</p>
NextGen Network Enabled Weather (NNEW) Service	<p>NNEW is a project to develop a 4-dimension (all points, lateral, vertical and time dimensions) weather data cube (4-D Wx Data Cube) from disparate contributors and locations.</p> <p>Live data is available from FAA through publish / subscribe mechanism and web services in multiple formats.</p>	<p>MPA</p> <p>UAS</p>
Weather Service International (WSI)	<p>WSI provides aviation products that streamline aeronautical decision-making with accurate and highly reliable weather data and decision support tools.</p>	<p>MPA</p> <p>RCS</p> <p>UAS</p>
Weather and Radar Processor (WARP) Service	<p>WARP is an automated processing and display system that acquires, processes, and disseminates Weather Surveillance Radar 88 Doppler (WSR-88D) Next-Generation Weather Radar (NEXRAD) data to air traffic personnel.</p> <p>Live data is available from FAA through publish / subscribe mechanism in multiple formats.</p>	<p>MPA</p> <p>RCS</p> <p>UAS</p>



Simulated Operational Data

Data	Description	Consumer
Airport Surface Detection Equipment -Model X (ASDE-X) Services	<p>The ASDE-X system is an automatic detecting, high-resolution ground surveillance radar system that tracks and identifies aircraft and surface vehicle movement over all of an airport's taxiways and runways.</p> <p>Live data is available from ASDE-X data distribution through publish / subscribe service in Asterix Category 011 format.</p>	MPA TowerUAS
ADS-B	An ADS-B service is a surveillance technology for tracking aircraft as part of the NextGen.	ATM MPA UAS Tower RCS
HOST Air Traffic Management Data Distribution System (HADDS)	HAADS is a server that stores and distributes Common Message Set data. The NIEC uses the HAADS to simulate flight plan data from URET, TMA, ERAM and CMS.	ATM Tower MPA
System Wide Information Management (SWIM)	SWIM data is presented to the NIEC graphical display using DESIREE.	ATM MPA Tower (TFDM)
Target Generation Facility (TGF)	TGF is an air traffic simulation capability that generates interactive traffic and weather for project scenarios. TGF allows the NIEC to receive data from NAS test system at the WJHTC (ERAM, STARS, and Common Automated Radar Terminal System (ARTs). The TGF also provides data for UAS and Tower in the NIEC.	En Route Tower MPA UAS Research Cockpit Simulator
Traffic Management Advisor (TMA)	Provides metering capabilities with situational awareness and graphical display. The NIEC uses the HADDS as the interface for TMA data.	ATM MPA



Adaptation Data

Data	Description	Consumers
ACES Adaptation	Adaptation Controlled Environment System provides Adaptation data (maps, fixes, airports, etc.) for NAS En Route and Terminal Environments.	ATM Tower MPA UAS
ASDE-X Adaptation	ASDE-X Adaptation data.	Tower
URET Adaptation	User Evaluation Tool Adaptation provides URET display data.	ATM
ERAM Adaptation	En route Automation Modernization Adaptation replaces ACES Adaptation providing (fixes, airports, maps, etc...).	ATM
TFM Adaptation	Traffic Flow Management data to support TFM functionality (Playbooks, destinations, etc.).	ATM Tower MPA
STARS Maps	STARS provides display data for terminal maps.	Tower MPA



Other Data

Data	Description	Consumers
Web Weather Services	Live data is available from FAA server internet connection weather services.	Cockpit out the window Tower display
Military Flight Data	MFD is aircraft data pertaining to Military flights	UAS DESIREE TGF



NIEC Past and Currently Planned Projects

- The following slides contain a listing of the past and currently planned projects.



NIEC Projects (Past and Currently Planned)

Month/Year	Title	Description	Sponsor	NIEC Capabilities Used
12/2009	AAI's RQ7 Shadow Simulator (SP) Achieved Performance Model Verification	The RQ7 Shadow Simulator verification and calibration activity is the precursor to validation activities to support UAS integration into the Next Generation National Airspace Transportation System.	UAS Program and UFIT (UAS FAA Industry Team) CRDA partners	AAI's RQ7 Shadow Simulator
05/2010	GA Pred B Simulator Achieve Performance Model Verification	Simulation using the UAS Reaper simulator and TGF to replicate a field flight of the MQ9 Reaper UAS.	UAS Program and UFIT (UAS FAA Industry Team) CRDA partners	GA Pred B Simulator
2/2010 – 5/2010 ----- 1/2011	Staffed NextGen Tower 1.0 Staffed NextGen Tower 1.5	SNT is assessing the tools and applications that would be necessary to perform ATC Tower operations at a given airport from an adjoining TRACON. Project compared features available in ASDE-X with features being developed by MIT-LL in an application called Tower Information Display System (TIDS) and Flight Data Management (FDM). SNT utilizes the Virtual Airport Immersion Environment [VAIE] area of the NIEC.	Michele Triantos, AJP-66 MIT/LL partners Michele Triantos, AJP-66 MIT/LL partners	Tower suite DESIREE ASDE-X DBRITE TGF VAIE TIDS FDM data collection Tower suite VAIE DESIREE DBRITE TGF TIDS FDM TIDS Embedded Cameras data collection



NIEC Projects (Past and Currently Planned)

Month/Year	Title	Description	Sponsor	NIEC Capabilities Used
12/2010	Mini INI	Initial NAS integration of UAS in the NAS with FMS for 4D TBO	UAS Program and UFIT (UAS FAA Industry Team) CRDA partners	UAS suite ATM suite DESIREE ZJX airspace data collection 2 ERAM R&D sectors 2 Terminal facilities
3/2011	Demo-1SE: ScanEagle Achieved Performance Model Verification	ScanEagle Achieved Performance Model Verification Study via flight at Warren Grove	CRDA partners	UAS suite
5/2011	4D FMS TBO	Medium-fidelity Human-in-the-Loop simulation, assessing pilot and controller issues linked to trajectory-based operations, using the ETA function of aircraft Flight Management Systems (FMS).	Neal Seuchy, ATO-P Mitre partners	ATM suite Multi-Purpose suite DESIREE TGF data collection ERAM, including medium-high-fidelity TMA functionality at a low/moderate arrival flow to a TMA- designated metering fix, with aircraft using FMS with varied levels of ETA capabilities.



NIEC Projects (Past and Currently Planned)

Month/Year	Title	Description	Sponsor	NIEC Capabilities Used
08/ 2011 – 9/2011	UAS NAS Integration: lost link assessment	UAS INI 2 follow-on work for UAS NAS Integration. This focused study will evaluate UAS experiencing “lost-link” hazards and will allow for continued exploration of the effects of adding a Cockpit Display of Traffic Information (CDTI) to the UAS pilot’s tool suite	UAS Program and UFIT CRDA partners AJP-65	UAS suite MQ-9 Predator B CDTI DESIREE TGF Data collection
6/2011	UAS NextGen Demonstration 4 HITL	NAS, “Demo 4” will continue to explore and evaluate the effects of adding aCDTI to the UAS pilot’s tool suite. This study will incorporate multiple surveillance feeds to the CDTI (including primary radar), and a future communication system (i.e, integrated IP addressable NextGen Voice Switch)	Research, Technology, and Development Group (AJP-67) and Engineering Development Services Group (AJP-65) with the support of inter-agency and industry partners.	UAS suite DESIREE TGF Data collection
12/2011	Field flight			Field flight will take place at Cape Canaveral
6 – 7/2011	Staffed NextGen Tower (SNT) HITL 2.0	The NIEC has been supporting the SNT project for the past year, assessing the tools and applications that would be necessary to perform ATC Tower operations at a given airport from an adjoining TRACON. In FY11, SNT is scheduled to conduct further tests with TIDS, utilizing embedded cameras in the TIDS application for monitoring aircraft circumstances.	Michele Triantos, AJP-66 MIT/LL partners	Tower Suite VAIE DESIREE TIDS FDM TIDS inboard Embedded Cameras Eye Tracker Multiple Outboard Panoramic, Auto Tracking, and stationary Cameras Data Collection



NIEC Projects (Past and Currently Planned)

Month/Year	Title	Description	Sponsor	NIEC Capabilities Used
August 2011	Multi-UAS Operational Assessment: Victorville, California	This is a real-time, human-in-the-loop simulation that supports a near-term initiative for integrating UAS operations in the NAS. The goal of the study is to identify and document events associated with mixing multiple, dissimilar, UAS operations with manned aircraft operations specifically within the Class D airspace of the Southern California Logistics Airport, Victorville, CA (KVCV). The scope of the effort is scaled to match the exploratory nature of the design approach. Will use Serco Inc. air traffic controllers who supply contract tower services at KVCV	FAA Engineering Development Services (AJP-65) at the FAA's Tower Visualization System in the Airport Facility Terminal Integration Lab, and support by several other Laboratory Services teams (AJP-7).	TGF TGF data collection VAIE computers DESIREE rehost Project takes place in AFTIL RDHFL support
September 2011	Net Enabled Operations (NEO) Demonstration 5	Real-time, human-in-the-loop study to investigate the integration of UAS into the NAS. Goal is to explore the NextGen concept of 4DT TBO and data sharing, within the scope of specific UAS hazards such as the loss of command and control "lost-link". The simulation will explore how a UAS equipped with an FMS will dynamically exchange aircraft intent information with an air traffic control automation system (STARS).	Research, Technology, and Development Group (AJP-67) and Engineering Development Services Group (AJP-65) with the support of inter-agency and industry partners. Florida NextGen Test Bed partners	UAS suite Textron AAI RQ-7B Shadow UAS equipped with a GE FMS. ATM suite DESIREE TGF Data collection Interface to STARS laboratory R& D Enclave



NIEC Projects (Past and Currently Planned)

Month/Year	Title	Description	Sponsor	NIEC Capabilities Used
10/2011 - 11/2011	NEO Demonstration 6	NEO Demo 6 builds upon the effort of NEO Demo 5 and UAS NextGen Demo 4. The demonstration activities will continue to explore the NextGen concept of 4DT TBO and data sharing, within the scope of specific UAS hazards such as the loss of command and control "lost-link". The data sharing scope will be expanded to create a much larger network of publishers and subscribers to include the NextGen Florida Test Bed. It will also integrate an additional automation system (i.e. ERAM).	Research, Technology, and Development Group (AJP-67) and Engineering Development Services Group (AJP-65) with the support of inter-agency and industry partners. Florida NextGen Test Bed partners	UAS suite Textron AAI RQ-7B Shadow UAS equipped with a GE FMS.ATM suite DESIREE TGF Data collection Interface to STARS laboratory R& D Enclave
11/2011	GBAS Project Newark	Project Newark is a NextGen demonstration project with the end goal of investigating the potential benefits of Satellite Navigation (SATNAV) in a congested airspace.	Federal resources and much of TGF staff	ATM suite AFTIL Common Arts TGF
Tentative 2011/2012	DataComm MCDU Integration	Controller in the NIEC area will send an Uplink to an aircraft, and that Uplink message will appear in the MCDU of an aircraft in the Hangar.	Steve Ferra, AJP-661 Pete Muraca AJP-173	ATM suite DESIREE ZMA Airspace DataComm MCDU Data collection Aircraft in Hangar
Schedule is TBD due to funding.	Weather Technology in the Cockpit (WTIC)	The purpose of the simulation is to better understand pilot decision-making in a collaborative environment with airline dispatch and ATC when provided with adverse weather conditions during transoceanic flights through the Intertropical Convergence Zone (ITCZ).	Gary Pokoner AJP-6810, manager of the Weather Technology in the Cockpit program is the project sponsor. NCAR partners	RCS suite RCS DESIREE Data collection



NIEC Evolution

- The following slides contain a listing of the capabilities that may be needed for the NIEC to conduct future NextGen research and the timeframe they are needed, based on:
 - Current NIEC plans, verified through the analysis of the NextGen mid-term concepts
 - Capability gaps identified through the analysis of the NextGen mid-term concepts
- Legend:
 - P = Planned, Verified
 - C = Timeframe driven by customer needs
 - G = Gap identified in the analysis
 - TBD = Timeframe needs to be determined



Evolution of the NIEC – ATM Area

Capability	Description	Fiscal Year				
		11	12	13	14	15
Terminal Automation Modernization Replacement (TAMR)	Upgrade existing STARS emulation to include TAMR functionality			G		
Common ATM automation infrastructure and displays.	Oceanic simulation capability to be added to DESIREE	C				
Common ATM automation infrastructure and displays.	Capability in DESIREE to display aircraft on terminal display w/ PRM configuration	C				
Common ATM automation infrastructure and displays.	Acquire “ERAM-IN-A-BOX” (EIB) and integrate with DESIREE. Contains capability to support current Host capability and can be expanded to support NextGen functionality	P				
Support 4DT Profiles	Add a 4DT capability to DESIREE for the oceanic, en route, and terminal automation.		P			
ERIDS Display	Purchase 9 ERIDS Displays as an extension of the ERIDS Lab. Must be flexible and reconfigurable, such that the consoles can be driven by the different automation systems (ERIDS, SAIDS, ACE/IDS and/or an emulation of them). An ERIDS display is need in the TMU section of the NIEC Lab.		P			
Terminal Automation Modernization Replacement (TAMR)	Upgrade existing STARS emulation to include TAMR functionality			G		
Common En Route and Terminal Air Traffic Information Displays	A common platform must be developed to support the emulation of SAIDS, ACE-IDS or any other Info Display System. Need specific guidance from an actual project to begin.	C				
Automated Terminal Proximity Alert (ATPA)	A terminal automation safety alerting tool.	P				



Evolution of the NIEC - MPA

Capability	Description	Fiscal Year				
		11	12	13	14	15
Traffic Flow Management Workstation	Need elements from the TMU at the ARTCC's and the Command Center. Includes TSD, FSM, and RMT displays and should be collocated with Weather components. ESIS should be visible by both TFM and ATC control area or two might be needed. ERIDS must be included. Time Based Flow Metering (TBFM) Timeline and Planview GUIs, or future equivalent.		P			
Remote TMUs	Remote Site Equipment and Displays. These are the displays at the remote TMU's.	TBD				
Mini-TPC	Mini - Traffic Flow Management Production Center (TPC). Integrate TFM Auxiliary Platform (TAP) into the NIEC and have the ability to manipulate on the TSDs.		P			
TFMS Test Tool	TFMS Test Tool (Simulates the input data for the mini-TPC)		P			
TMA/TBFM	TMA/TBFM Integration with DESIREE and TGF	C				
Additional workstations for ancillary FAA positions	Sufficient workstations and the physical space and locations to perform all the ancillary functions needed for coordination during an evaluation. For example, an objective of an exercise may be to examine how traffic management positions in different facilities with different responsibilities and DSTs interact in response to a TMI. A TMI due to weather may affect several domains and the TMC positions and possibly a weather coordinator position may have to be staffed.		G			
Workstations and emulation for non-FAA entities.	More workstations and capabilities to emulate local entities (e.g., airport authorities) and other government systems (e.g., DHS, DoD) for the exchange of information for situational awareness and coordination.		G			
Relative Position Indicator (RPI)	A traffic management decision support tool	P				



Evolution of the NIEC – RCS (1 of 2)

Capability	Description	Fiscal Year				
		11	12	13	14	15
Data Comm	Data Comm capability with VDL Mode 2 radio		G			
GPS Positioning	GPS derived positioning for navigation including WAAS and LAAS (GBAS)			G		
Integrated Avionics	Ability to integrate hardware (red label) avionics & integrate software modules for exploring future concepts		P			
FANS-1A	Incorporate the Future Air Navigation System (FANS) 1A		G			
Weather Displays	Simulated/repeatable weather shown on navigation displays & out the window; Systems modular, can swap lower for higher fidelity unit; CDTI in cockpit w/ TGF provided data.	P				
4D Weather Cube	Integrate 4D Cube Wx			G		
FMS	Simulated FMS vs Honeywell Step 1 Pegasus FMS		P			
Configuration of other aircraft types	Manned Flight/Cockpit Simulator (Bus Jet, B777, B737-800, EMB-175) - Medium fidelity flight simulator with avionics suite consistent with GA and/or Business Jet aircraft, ADS-B In/Out UAT link only, VHF and Data Comm (VDL-2) and GPS derived PNT.	P				
Specific FMSs	FMS capability for each a/c type		C			



Evolution of the NIEC – RCS (2 of 2)

Capability	Description	Fiscal Year				
		11	12	13	14	15
FMS	Incorporate Honeywell Pegasus FMS into the Cockpit.		P			
4-DT	Integrate with Data Comm capability & TGF Enable 4-D trajectory negotiation and operations		P			
ADS-B	Incorporate ADS-B, including FIS-B and TIS-B into the NIEC Cockpit Simulator.		P			
SURF-IA	Runway safety application for flight crews for use with CDTI/TIS-B/ADS-B			G		
ADS-B Flight Deck Interval Management – Sequencing (FIM-S) software.	A gap may be the Ground Interval Management – Sequencing (GIM-S) These may be prototypes that are evaluated in the NIEC.			G		
Synthetic Vision System (SVS), Enhanced Flight Vision System (EFVS)	Create or emulate capabilities that can be used for low visibility conditions. Effectiveness of real systems may be limited by the simulated Out the Window environment.		G			
FMS	Incorporate Honeywell Pegasus FMS into the Cockpit. Integrate with Data Comm capability & TGF		P			



Evolution of the NIEC – General Services and Data Feeds (1 of 2)

Capability	Description	Fiscal Year				
		11	12	13	14	15
TGF: 4D Profiles	All TGF simulated aircraft shall have the capability to fly "4DT profiles".		P			
TGF: Aircraft Target Generator for Oceanic	Capability to inject simulated aircraft to the oceanic automation as they appear to come from the typical oceanic surveillance sources.	C				
Aircraft-specific simulators	These desktop simulators shall be capable of emulating different airframes and different performance levels consistent with a mixed equipage environment (varying CNS elements) and information displays. Include FMS-like capability and data comm capability.	C				
Ground-ground data communication	Realistic emulation of inter and intra facility ground-ground communication.	TBD				
SWIM Segment 1 Services	NIEC will integrate SWIM segment 1 services as they become available. In FY'11 NIEC integrated ITWS data publication into ATM area. TGF and DESIREE were adapted to publish data to TFDM using SWIM software in FY'11.	P	P	P	P	P
Navigation	Emulation of GPS-based navigation as primary source, Loran - backup to GPS, Wide Area Augmentation System (WAAS), LAAS (Local Area Augmentation System), RNP, etc.	P				
ADS-B	Provide infrastructure to provide ADS-B data to both ground automation and the cockpit simulators. FIS-B	P				
Precision Runway Monitor (PRM)	Integrate PRM into DESIREE	C				
TGF: 4D Profiles	All TGF simulated aircraft shall have the capability to fly "4DT profiles".		P			



Evolution of the NIEC – General Services and Data Feeds (2 of 2)

Capability	Description	Fiscal Year				
		11	12	13	14	15
Recorded Weather	Automate and integrate playback of recorded weather with TGF and DESIREE	P				
Video Data Collection and Streaming	Video capture capability for all the areas where participants would be working simulations and a capability to stream live video to the CVA.	P				
Scenario Development Tools	Tools to develop and validate air traffic scenarios	P		.		
Scenario Development Tools	A robust capability to create multi-dimensional scenarios involving Air Traffic data, TFM data, and weather data that can be time-synched and repeatable to support real-time HITL simulations. Weather data may be from multiple weather systems.		P			
Aeronautical Information Management (AIM)	Data feed (through SWIM) for AIM information.				G	



CENTER FOR ADVANCED AVIATION SYSTEM DEVELOPMENT

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